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GREEN COMMUNITIES PROGRAM
DEPARTMENT OF ENERGY RESOURCES

*Helping Massachusetts Municipalities Create a Greener Energy Future*

**Green Communities Webinar**

**November 3rd, 2010**

# The MA 'Stretch' Energy Code 201


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# Green Communities Division

Serves as the hub for all Massachusetts cities and towns on energy matters

# Recording & Presentation

- The webinar was recorded and will be available for viewing at your convenience. It will be posted on our website at:

  www.mass.gov/energy/greencommunities

- The slide presentation will also be posted at:

  www.mass.gov/energy/greencommunities

- Websites are also listed at end of presentation

# Stretch Code: Poll #1

What portions of the stretch code are you most interested in hearing about today?

- Residential
- Commercial
- Equal time for Both

# Summary

- Energy/stretch code recap
- May 2010 updates to the stretch code
- Future Energy code
- Value of the stretch code approach
- Case studies
- Questions

# MA Energy Codes 2010-2012

- IECC 2009 since July 1, 2010
  - Roughly 10% more energy efficient than 2006
  - ASHRAE 90.1-2007 commercial option

- Towns and Cities can opt into the “Stretch Code” appendix
  - Approx 20% more energy efficient than IECC 2009 or ASHRAE 90.1-2007

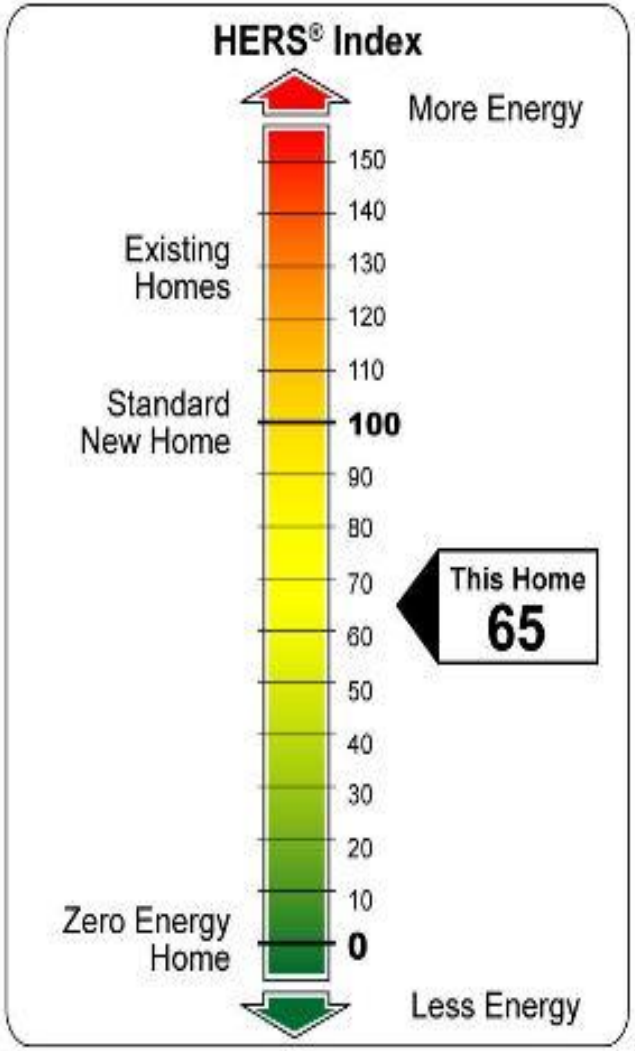
# Residential Recap

New Homes = Performance

- HERS rating of 65 or 70
- Energy star checklist

Renovations or Additions:

- Performance (HERS) or
- Prescriptive code
- Energy star checklist



# Commercial Recap

- New buildings & additions only
- Prescriptive code 5,000-100,000 sq ft

nbi new buildings institute

- Performance over 100,000 sq ft.
  - Uses ASHRAE / LEED energy model

# Performance Energy Code

## Performance path = an Energy Model

- HERS Rating is an energy model of the home/unit (estimates energy use / sq ft)
- ASHRAE appendix G is the LEED energy model for commercial bldgs. (also energy use /sq ft)
- Design decisions lead to better buildings
- Occupants are unknown so assume average behavior

# Prescriptive Energy Code

Prescriptive = detailed minimum standards

- How much insulation, air sealing is needed
- What kind of windows, heating/cooling equipment, etc, are good enough
- What controls, design details are required
- Sets minimum spec. - design flexibility is to go higher, with some trade-offs

# Stretch Code Updates

# Stretch Code Updates (May 2010)

- Updated FAQ (Oct 2010) on BBRS website: http://www.mass.gov/Eeops/docs/dps/inf/faqs_stretch_energy_code_qa_oct11_10.pdf

Q&A for MA Stretch Energy Code Appendix 780CMR 115.AA

**Stretch Appendix to the Building Energy Code in Massachusetts**

**Question and Answer (Q&A) – October 2010**


| General Questions | Page |
|---|---|
| 1. What is the 'stretch' code? | 2 |
| 2. How is the stretch code different from the existing 'base' energy code? | 2 |
| 3. Why did the Board of Building Regulations and Standards (BBRS) create this option? | 2 |
| 4. What are the expected benefits to a municipality of a more stringent energy code? | 2 |
| 5. What is the anticipated cost of implementing a more stringent energy code? | 3 |
| 6. Where can I find and read more about the stretch code appendix? | 3 |
| ***Scope*** | |
| 7. What building types does the stretch energy code apply to? | 3 |
| 8. Does the stretch code apply to major renovation projects as well as new construction? | 3 |

# Stretch Code Updates (May 2010)

- May 2009 Stretch code voted in by BBRS
  - First published in August 2009
- May 2010 BBRS approved modifications
  - 7th edition appendix 120.aa **(June 2010)** or
  - 8th edition appendix 115.aa
- 2 Main Changes in May 2010:
  - 401.3 Residential prescriptive path simplified
  - 501.1.2 Commercial performance path mandatory requirements clarified

# Appendix 120.aa or 115.aa How to Adopt the Latest Version?

## If you are already a 'stretch code' community

- No action needed – MA 8th edition bldg. code changes don't affect energy chapter or stretch code
- Reference to 7th edition 120.aa changes to 8th edition 115.aa once MA code update is completed

## If you are considering 'stretch code' adoption

- Bylaw/ordinance reference to 120.aa or 115.aa is acceptable. After February 6th, 2011, reference should be made to 115.aa

# Residential Updates

- Additions and Renovations – prescriptive path is simplified.
  - Removed reference to Energy Star BOP

401.3 Prescriptive - Meet IECC 2009 plus:

1. Energy Star Thermal Checklist.
2. Energy Star v5.0 for **new** Doors, Windows and Skylights
3. Ducts for **new** HVAC systems max 4 cfm per 100 $ft^2$ (4% leakage to outside)

# ENERGY STAR Qualified Homes
# Thermal Bypass Inspection Checklist

Home Address:_____ City:_____ State:_____

| Thermal Bypass | Inspection Guidelines | Corrections Needed | Builder Verified | Rater Verified | N/A |
|---|---|---|---|---|---|
| 1. Overall Air Barrier and Thermal Barrier Alignment | **Requirements:** Insulation shall be installed in full contact with sealed interior and exterior air barrier except for alternate to interior air barrier under item no. 2 *(Walls Adjoining Exterior Walls or Unconditioned Spaces)* | | | | |
| | **All Climate Zones:** | | | | |
| | 1.1 Overall Alignment Throughout Home | ☐ | ☐ | ☐ | ☐ |
| | 1.2 Garage Band Joist Air Barrier (at bays adjoining conditioned space) | ☐ | ☐ | ☐ | ☐ |
| | 1.3 Attic Eave Baffles Where Vents/Leakage Exist | ☐ | ☐ | ☐ | ☐ |
| | **Only at Climate Zones 4 and Higher:** | | | | |
| | 1.4 Slab-edge Insulation (A maximum of 25% of the slab edge may be uninsulated in Climate Zones 4 and 5.) | ☐ | ☐ | ☐ | ☐ |
| | **Best Practices Encouraged, Not Req'd.:** | | | | |
| | 1.5 Air Barrier At All Band Joists (Climate Zones 4 and higher) | ☐ | ☐ | ☐ | ☐ |
| | 1.6 Minimize Thermal Bridging (e.g., OVE framing, SIPs, ICFs) | ☐ | ☐ | ☐ | ☐ |
| 2. Walls Adjoining Exterior Walls or Unconditioned Spaces | **Requirements:**<br>• Fully insulated wall aligned with air barrier at both interior and exterior, **OR**<br>• Alternate for **Climate Zones 1 thru 3**, sealed exterior air barrier aligned with RESNET Grade 1 insulation fully supported<br>• Continuous top and bottom plates or sealed blocking | | | | |
| | 2.1 Wall Behind Shower/Tub | ☐ | ☐ | ☐ | ☐ |
| | 2.2 Wall Behind Fireplace | ☐ | ☐ | ☐ | ☐ |
| | 2.3 Insulated Attic Slopes/Walls | ☐ | ☐ | ☐ | ☐ |
| | 2.4 Attic Knee Walls | ☐ | ☐ | ☐ | ☐ |
| | 2.5 Skylight Shaft Walls | ☐ | ☐ | ☐ | ☐ |
| | 2.6 Wall Adjoining Porch Roof | ☐ | ☐ | ☐ | ☐ |
| | 2.7 Staircase Walls | ☐ | ☐ | ☐ | ☐ |
| | 2.8 Double Walls | ☐ | ☐ | ☐ | ☐ |
| 3. Floors between Conditioned and | **Requirements:**<br>• Air barrier is installed at any exposed fibrous insulation edges | | | | |

# ENERGY STAR Qualified Homes
# Thermal Enclosure System Rater Checklist

Home Address: _____ City: _____ State:_____

| Inspection Guidelines | Must Correct | Builder Approved[1] | Rater Approved | N/A |
|---|---|---|---|---|
| **1. High-Performance Windows** | | | | |
| 1.1 *Prescriptive Path:* Windows shall meet or exceed ENERGY STAR window requirements[2] | ☐ | ☐ | ☐ | ☐ |
| 1.2 *Performance Path*: Windows shall meet or exceed 2009 IECC requirements[3] | ☐ | ☐ | ☐ | ☐ |
| **2. Quality-Installed Insulation** | | | | |
| 2.1 Ceiling, floor, and wall insulation levels shall meet or exceed 2009 IECC levels[4] | ☐ | ☐ | ☐ | ☐ |
| 2.2 For Climate Zones 4 and higher, slab insulation shall meet or exceed 2009 IECC levels[4] | ☐ | ☐ | ☐ | ☐ |
| 2.3 Insulation shall achieve RESNET-defined Grade I installation or, alternatively, Grade II for walls with insulated sheathing, (see checklist item 4.3.1 for required insulation levels) | ☐ | ☐ | ☐ | ☐ |
| **3. Fully-Aligned Air Barriers** [5] | | | | |
| At each location noted below, a complete air barrier shall be provided that is fully aligned with the insulation as follows:<br>• At interior surface of ceilings in all Climate Zones<br>• At exterior surface of walls in all Climate Zones; and also at interior surface of walls for Climate Zones 4-8[6]<br>• At interior surface of floors in all Climate Zones, including supports to ensure permanent contact and blocking at exposed edges[7] | | | | |
| 3.1 Walls | | | | |
| 3.1.1 Walls behind showers and tubs | ☐ | ☐ | ☐ | ☐ |
| 3.1.2 Walls behind fireplaces | ☐ | ☐ | ☐ | ☐ |
| 3.1.3 Attic knee walls | ☐ | ☐ | ☐ | ☐ |
| 3.1.4 Skylight shaft walls | ☐ | ☐ | ☐ | ☐ |
| 3.1.5 Wall adjoining porch roof | ☐ | ☐ | ☐ | ☐ |
| 3.1.6 Staircase walls | ☐ | ☐ | ☐ | ☐ |
| 3.1.7 Double walls | ☐ | ☐ | ☐ | ☐ |
| 3.1.8 Garage rim / band joist adjoining conditioned space | ☐ | ☐ | ☐ | ☐ |
| 3.1.9 All other exterior walls | ☐ | ☐ | ☐ | ☐ |
| 3.2 Floors | | | | |

# Stretch Code: Poll #2

Who completes and signs the EPA thermal checklist for the residential prescriptive path (most home additions and renovations)?

- HERS rater only
- Builder and HERS rater
- Builder only
- Any combination of the above

# Commercial Updates

## Performance path mandatory requirements clarified

The ASHRAE 90.1-2007 appendix G, energy model is not a stand-alone code compliance path, so some prescriptive code requirements are also needed

## Two choices: Stretch code prescriptive path or ASHRAE 90.1-2007 mandatory requirements

## Listed in section 501.1.2

- Appendix AA 502.4, 503.2, 504 and 505,

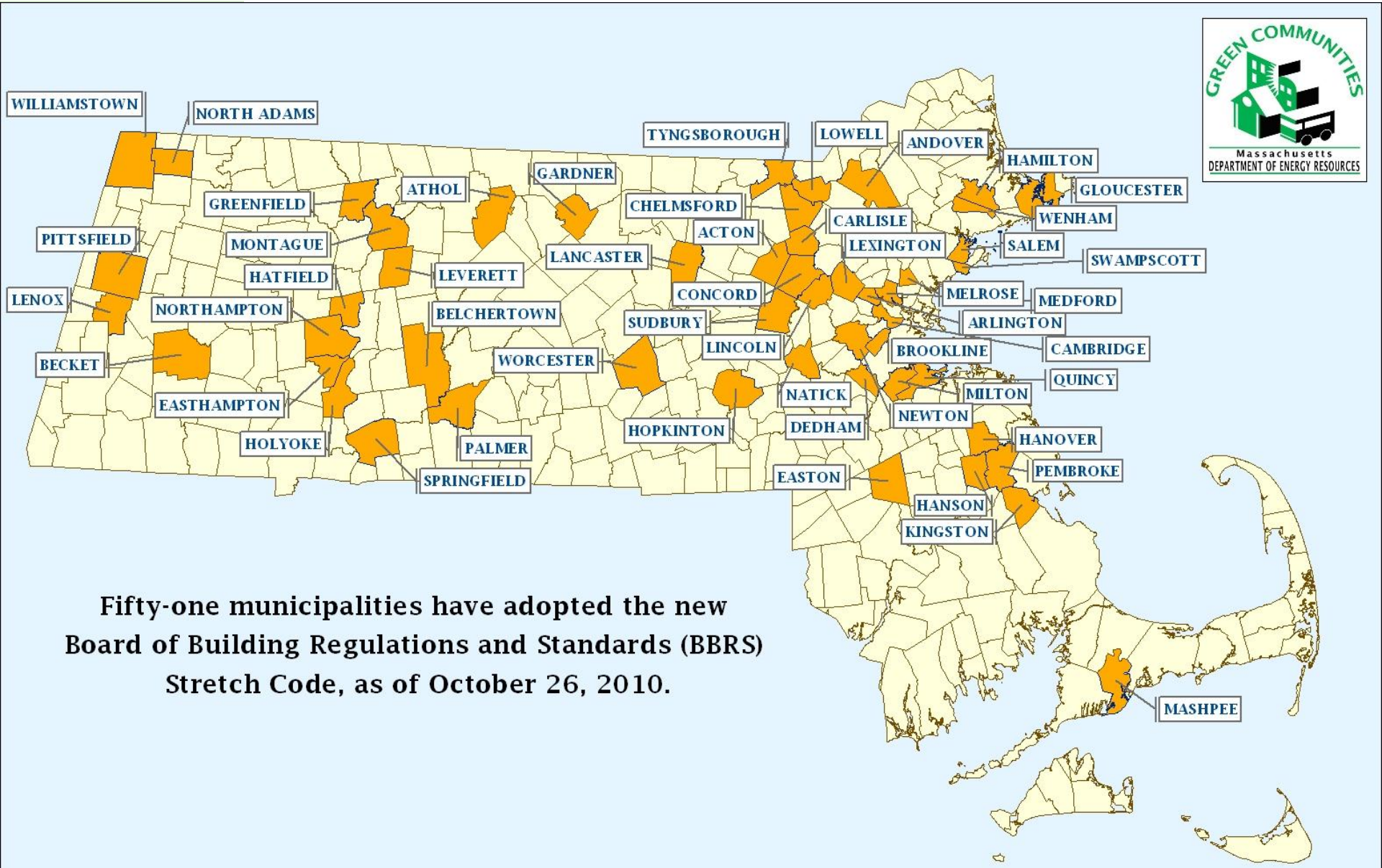
or

- ASHRAE 90.1-2007: 5.4, 6.4, 7.4, 8.4, 9.4, 10.4.

plus

- lighting requirements of Appendix AA TABLE 505.5.2

# Municipal Adoption Update




Fifty-one municipalities have adopted the new Board of Building Regulations and Standards (BBRS) Stretch Code, as of October 26, 2010.

# Code Training Update

- Wrapping up 40 trainings on IECC 2009 and stretch code.
  - Designed for building code officials
  - Builders, contractors, designers welcome

- New training coming soon – Winter 2011
  - Focused on building best practices
  - And how to meet the stretch code
  - Designed for builders/contractors/designers
  - Code officials, local govt, public welcome

http://cetonline.org/Events/events.php?id=124

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# Future Energy Code

# IECC 2012 – Big Energy Savings

November 2, 2010

## US Adopts 30% Energy-Efficiency Savings for Buildings

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RELATED STORIES

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Commercial Buildings Guzzle 37% of CA's Energy

More than 500 U.S. state and local code officials voted to adopt new building codes that will achieve 30 percent in energy savings, using the 2006 model code as the baseline, for commercial and residential buildings, reports the **American Council for an Energy-Efficient Economy** (ACEEE).

The new 2012 International Energy Conservation Code (IECC) will align with the 30 percent energy savings goal of the U.S. Department of Energy, the U.S. Conference of Mayors, the National Association of State Energy Officials, governors, lawmakers, and the broad-based Energy Efficient Codes Coalition (EECC), says ACEEE.

The model energy code governs residential and commercial building construction, additions, and renovations in 47 states and the District of Columbia where local building codes are based on these

# MA Energy Code in 2012/13
# IECC 2012 or Stretch 2012

- Residential – IECC stays mostly Prescriptive
  - Expected ~20% more efficient than 2009 in MA
- Commercial – IECC stays mostly Prescriptive
  - Adopts the MA stretch code prescriptive language
  - ASHRAE 90.1-**2010** allowed alternative
  - Expected ~20% more efficient than 2009 in MA
- New Stretch code in 2012/13
  - Requires BBRS approval
  - Issue of whether or not renewed adoption by municipality is required is under review, updated guidance will be issued when resolved.

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# Stretch code value

# Stretch Code – A Pathway to Zero Energy Buildings

Residential - more performance testing

- Provides home-buyer quality assurance
- Rewards MA builders for quality workmanship and good design
- Is the most cost-effective way to save energy in homes

Commercial – more energy design modeling

- Flexible and rewards whole-system energy design
- Prescriptive requirements are most cost-effective tested in our climate

# Stretch Code: Poll #3

What performance testing is already **required** for new homes in the MA residential energy code (IECC 2009)?

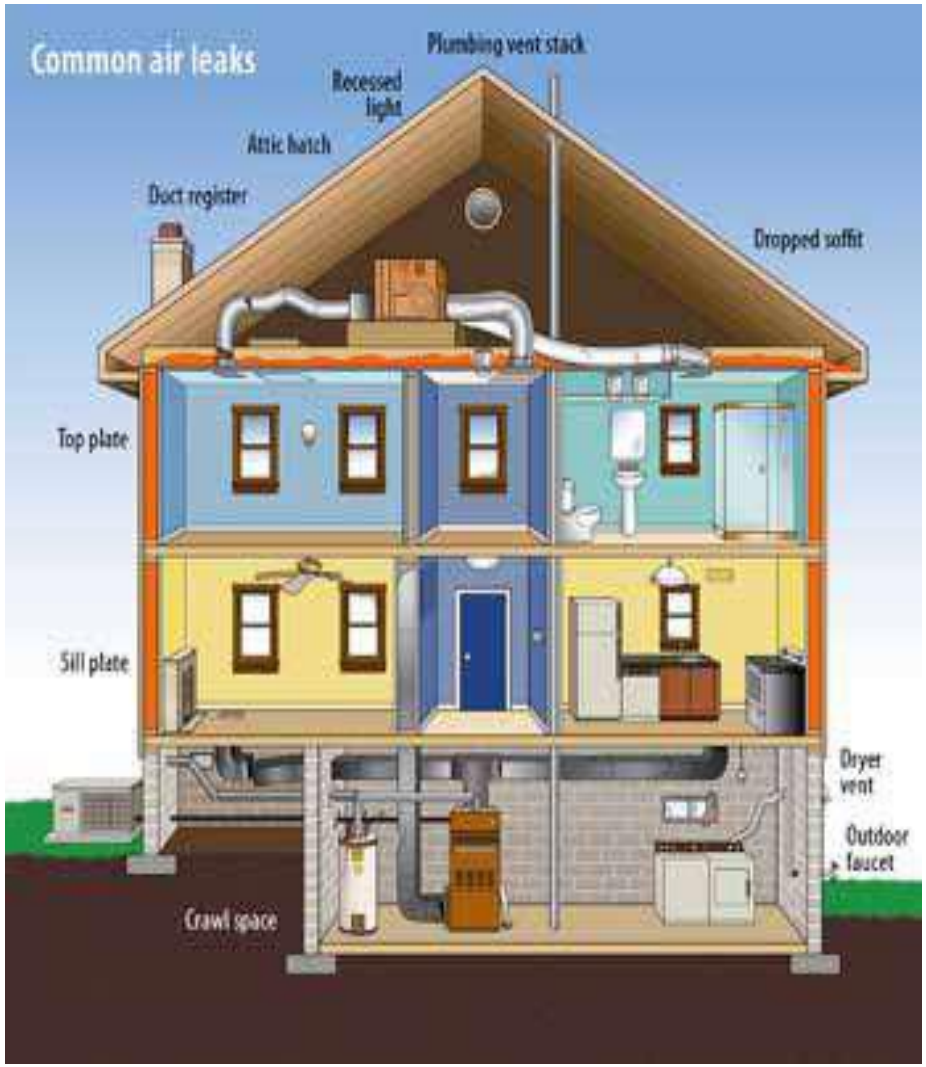
- Blower-door test of air leakage
- Duct-blaster test of duct air leakage
- Both duct-blaster and blower-door test
- No performance testing is required

# Residential Stretch Code = Performance Testing

# Why Test Performance?

Prescriptive codes don't guarantee good installation, air and water tightness, or that thermal insulation is effective.

e.g. Small air gaps can reduce insulation R-values by 50% or more



# Example: Insulation

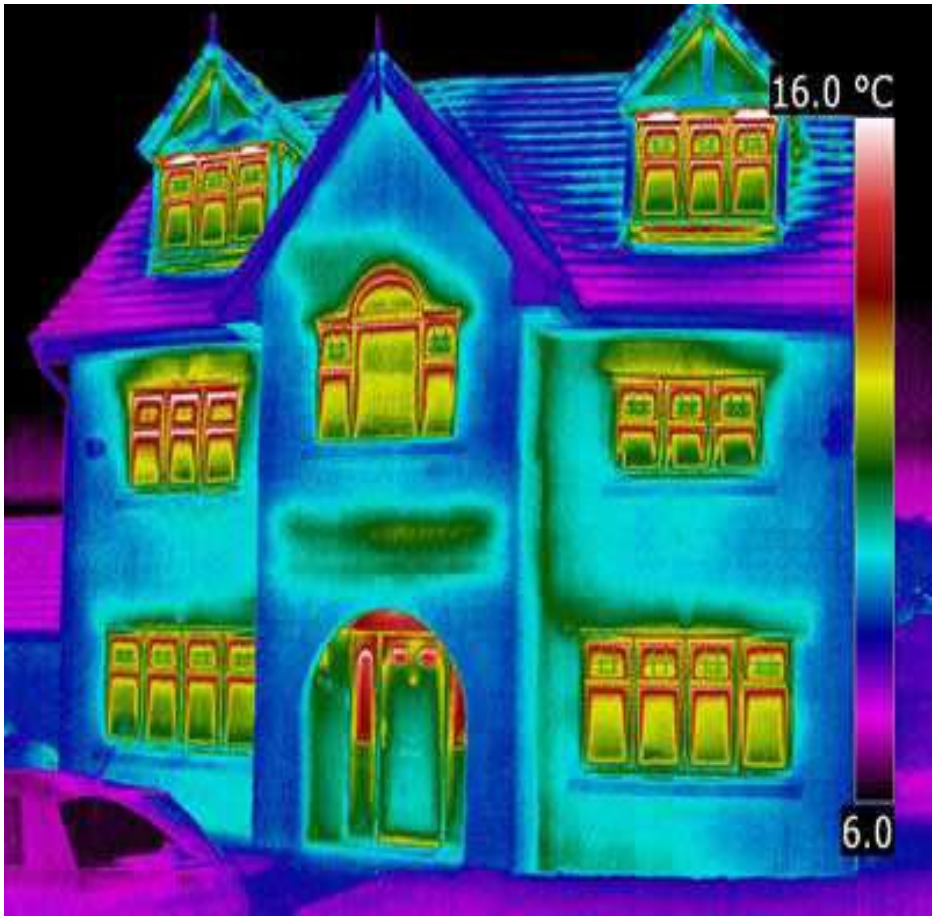
- Performance suffers rapidly when details aren't followed
- Quality installation is key
- Old energy codes didn't test this

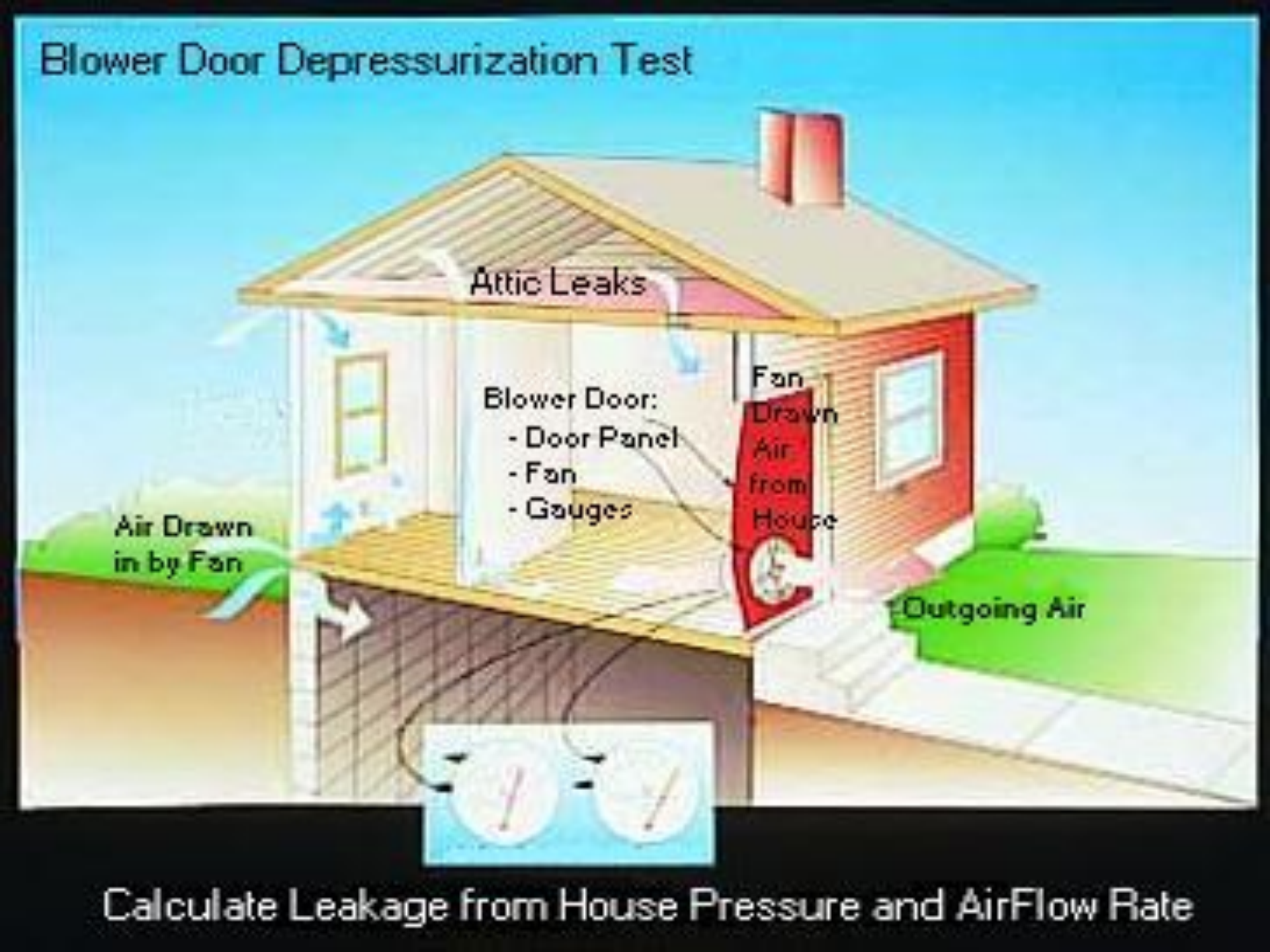

Photos courtesy Conservation Services Group ©

# Tools to Test Performance

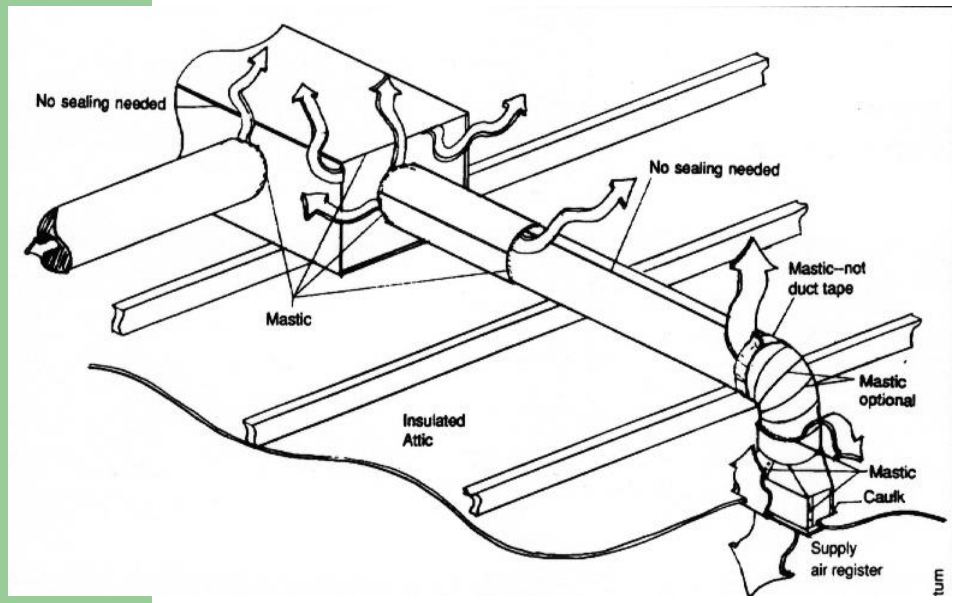
Stretch code requires:

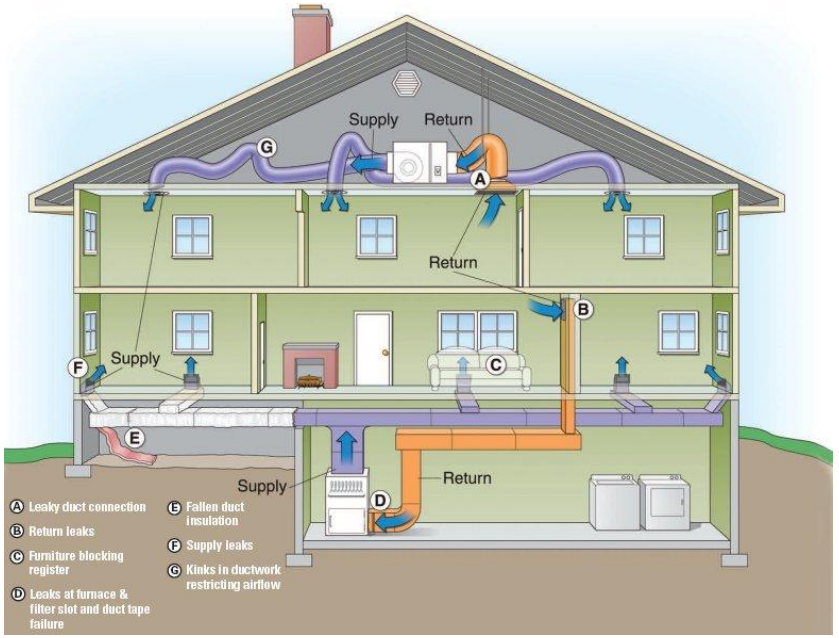
- Blower-door test for air leakage
- Duct test for heating & AC (unless all ducts are inside insulated space)
- Optional infra-red camera tests thermal barrier install.




Blower Door Depressurization Test
Attic Leaks
Blower Door:
- Door Panel
- Fan
- Gauges
Fan
Drawn
Air
from
House
Air Drawn
in by Fan
Outgoing Air
Calculate Leakage from House Pressure and AirFlow Rate

# Ducts Are Now Tested Under Both Base & Stretch Codes




- If all ducts are inside the insulated space – no test required, only test when ducts can leak to the outside

# Residential Stretch Code: Real World Examples in MA

# Stretch Code: Poll #4

What is the expected incremental cost to build an average sized stretch code home rather than to IECC 2009?

- $20,000
- $8,000
- $2,000
- Depends on the builder

# Small Townhouse Units
# (1,200 square feet)

# Small Townhouse Units
# (1,200 square feet)

| System | Code default | This Home |
|---|---|---|
| **Walls** | R-20 | R-19 |
| **Ceiling** | R-38 | R-41 |
| **Slab (Perim./Under)** | R-10/R-10 | R-10/R-10 |
| **Heating** | 78% AFUE | Hydro-Air, 92% |
| **Cooling** | 13 SEER | 14 SEER |
| **DHW** | | Integrated, 0.86 EF |
| **Air Leakage** | 7 ACH@50 | 5 ACH@50 |
| **Duct Leakage** | 8% of floor area | 6% of floor area |
| **HERS Index** | **~85** | **63** |

# Single Family
# (2,600 square feet)

# Single Family
# (2,600 square feet)

| | | |
|---|---|---|
| **Walls (cavity)** | R-20 | R-19 |
| **Ceiling (cavity)** | R-38 | R-37 |
| **Floor (cavity)** | R-30 | R-30 |
| **Slab (Perim./Under)** | R10/R10 | R5/R10 |
| **Heating** | 80% AFUE | Oil Boiler, 86% |
| **Cooling** | 13 SEER | 13 SEER |
| **DHW** | | Integrated 0.79 EF |
| **Air Leakage** | 7 ACH@50 | 5 ACH@50 |
| **Duct Leakage** | 8% | 6% of floor area |
| **HERS Index** | **~85** | **66** |

# Another Single Family (2,600 square feet)

# Another Single Family
# (2,600 square feet)

| | | |
|---|---|---|
| **Walls (cavity)** | R-20 | R-25 |
| **Ceiling (cavity)** | R-38 | R-59 |
| **Floor (cavity)** | R-30 | R-39 |
| **Foundation** | R10/13 | R0 |
| **Heating** | 78% AFUE | Furnace 80% |
| **Cooling** | 13 SEER | 13 SEER |
| **DHW** | | standalone 0.55 EF |
| **Air Leakage** | 7 ACH@50 | 2.5 ACH@50 |
| **Duct Leakage** | 8% | 0% (inside) |
| **HERS Index** | **~85** | **68** |

# Large Single Family
# (4,200 square feet)

# Large Single Family (gut-rehab) (4,200 square feet)

| | | |
|---|---|---|
| **Walls (cavity)** | R-20 | R-15 |
| **Ceiling (cavity)** | R-38 | R-34 |
| **Floor (cavity)** | R-30 | R-22 |
| **Slab (Perim./Under)** | R10/R10 | R10/R10 |
| **Heating** | 78% AFUE | Hydro-Air, 92% |
| **Cooling** | 13 SEER | 14 SEER |
| **DHW** | | Integrated 0.85 EF |
| **Air Leakage** | 7 ACH@50 | 5 ACH@50 |
| **Duct Leakage** | 8% | 6% of floor area |
| **HERS Index** | **~85** | **63** |

# Stretch Code – Top 5 Reasons

1. Consumer Protection – testing ensures new homes get built properly in practice – not just in theory

2. Its happening anyway – Almost all the stretch code language will be in the 2012 base energy code

3. Its good business – Designers and Builders who save energy are in demand – Energy star and LEED buildings sell faster, and others don't sell much at all.

4. The support is there – utility incentives and programs, state sponsored training, public support

5. It's the right thing to do – reducing energy imports and emissions, promoting local green jobs and improving buildings that will still be here in 2050

# Stretch Code Questions?

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